

LOCUS BSU13832 2800 bp DNA BCT 02-JUL-1996
DEFINITION Bacillus subtilis 168 highly hydrophobic integral membrane protein
(tagG) gene and ATP-binding protein (tagH) gene, complete cds.
ACCESSION U13832
NID g755151
KEYWORDS .
SOURCE Bacillus subtilis.
ORGANISM Bacillus subtilis
Eubacteria; Firmicutes; Low G+C gram-positive bacteria;
Bacillaceae; Bacillus.
REFERENCE 1 (bases 1 to 2800)
AUTHORS Lazarevic,V. and Karamata,D.
TITLE The tagGH operon of Bacillus subtilis 168 encodes a two-component
ABC transporter involved in the metabolism of two wall teichoic
acids
JOURNAL Mol. Microbiol. 16 (2), 345-355 (1995)
MEDLINE 96015447
REFERENCE 2 (bases 1 to 2800)
AUTHORS Lazarevic,V.
TITLE Direct Submission
JOURNAL Submitted (19-AUG-1994) Vladimir Lazarevic, Institut de Genetique
et de Biologie Microbiennes, Rue Cesar-Roux 19, Lausanne, 1005,
Switzerland
FEATURES Location/Qualifiers
source 1..2800
/organism="Bacillus subtilis"
/strain="168"
/map="310 degree"
-35_signal 189..194
/note="sigmaA-controlled promoter"
-10_signal 212..217
/note="sigmaA-controlled promoter"
misc_feature 225
/note="transcriptional start determined by primer
extension"
RBS 273..279
/gene="tagG"
gene 273..1114
/gene="tagG"
CDS 287..1114
/gene="tagG"
/codon_start=1
/function="teichoic acid translocation"
/product="highly hydrophobic integral membrane protein"
/db_xref="PID:g755152"
/transl_table=11
/translation="MNDLLRILREQITSFPLILRLAAYETKSKYQMNYLGVLWQFLNP
LIQMLAYWVFVGMGIRKGGPVTTGAGEVPFIIWMLAGLIPWFFISPTILDGSNSVFKR
INMVAKMNFPISSLPVAIASNLFSYMIMMVIYIIIVLLVNGVFPVHWLQYIYYFICM
IAFMFSFSLFNSTISVLIRDYQFLLQAVTRLLFFLLPIFWDVNAKLGQSHPELVPVLK
LNPLFYIIEGFRNSFLDGAFFFHDMKYTLYFWLFTFLLLLVGSILHMKFRDKFVDFL"
RBS 1120..1125

```
gene      /gene="tagH"
          1120..2717
CDS        /gene="tagH"
          1134..2717
          /gene="tagH"
          /codon_start=1
          /function="teichoic acid translocation"
          /product="ATP-binding protein"
          /db_xref="PID:g755153"
          /transl_table=11
          /translation="MKLKVSFRNVSKQYHLYKKQSDKIKGLFFPAKDNGFFFAVRNVSF
          DVYEGETIGFVGINGSGKSTMSNLLAKIIPPTSGEIEMNQPSLIAIAAGLNNQLTGR
          DNVRLKCLMMGLTNKEIDDMYDSIVEFAEIGDFINQPVKNYSSGMKSRLGFAISVHID
          PDILIIDEALSVGDQTFYQKCVDRINEFKKQGKTIFVSHSIGQIEKMCDRVAMHYG
          ELRMFDETKTVVKEYKAFIDWFNKLKKEKETKKEQTEERKKEDPEAFARFRKKKKK
          PKSLANAIQIAILSILTVFMAGTMFFNAPLRTIASFGAI PQNEVKNNHHGDAKGKSEER
          LTAINKQGFIANEKAAAYKDQGLKQKADVTLPFGTKVTVAAKKGQAAKIKFDGHSYYV
          KQSAVATNMKHAELHATAFTSYVSQNAASSYEYFLKFLGDSSTSISQSKLNGYTEGNKA
          DGRKTLNFDYEKISYVLENDKATELIFHNISPINPASLSLSDSDVLYDSSKKRFLVNT
          DDQVFAVDNEEHTLTMLK"
terminator 2718..2753
          /note="rho-independent"
BASE COUNT      849 a      468 c      608 g      875 t
ORIGIN
1 agatctcatc gcctgattat aagcttccgg tttcttttgg tccttttctat gataagtttt
61 gctattttaga gtcaggacgt tcatctgaaa aggttggttaa tactgtattt aaagctgaat
121 aatttagggtt attttataaaa atgtatagct gtcgattttt cggcagcttt ttagatactt
181 gttgagaagt gaaaaaaaaat gcaggatctg ttacaataat cagcggtgct ttc aaatttt
241 aacagaaaag attcccaaaa acaattaagt ctaaggaaga taaaaaatga atgatttggt
301 gcgtatactc agagagcaaa taacgtcatt tcctttaatt ttaagattgg cggcttatga
361 aaccaagtct aaatatcaaa tgaattattt aggtgtctta tggcagttct taaatccgct
421 tatccaaatg ctggcctact gggttcgtatt tgggtatggg attagaaagg gcggtcctgt
481 gacaaccgga gcgggcgaag tgccttttat tatgttgatg ctggcaggat taatcccatg
541 gtttttcatc agtccaacta tacttgatgg atcaaatagt gtatttaagc gcattaatat
601 ggtggctaaa atgaacttcc cgattagtcc tctaccgtcc gtggcaattg catctaactt
661 atttagttat atgatcatga tgggtgattta tatcattgta ctctagttta atggtgtggt
721 cccgagtgtg cattggttac aatatattta ttacttcac tcgtatgattg cttttatggt
781 ttcgttttagt ttgtttaact caacgatcag tgtgctgatt agagattatc aatttttgct
841 gcaggccgta acaagacttt tgtttttctt gttgccaat ttttgggatg ttaatgcgaa
901 actcgggtcaa agccaccccg aattagtgcc tgttctgaag ttgaatccac tattctatat
961 tattgaagga ttccggaaca gcttcttaga tggagcatgg tttttccatg acatgaagta
1021 cacgctgtac ttttggttgt tcacattcct tttattgta gtaggttcta tcctgcatat
1081 gaaattcaga gacaagtttg ttgactttct ttaatacgta aggagatttt acgatgaaac
1141 taaaagtttc gtttcgaaat gtttcaaagc agtatcattt gtataaaaaa caatcggaca
1201 agattaaagg attgtttttt ccggctaagg ataatggttt ttttgctgtg cggaatgtct
1261 cttttgacgt gtatgaaggg gagacaatcg gctttgtagg aataaacggg tcaggaaaat
1321 cgaccatgtc taacctgctg gctaaaatta ttccgccgac cagcggtgaa attgaaatga
1381 acggccagcc gtcgctgatt gcgattgctg ccggtttgaa taaccaatta acgggccggg
1441 acaatgtccg gctcaagtgt ttgatgatgg ggtaaccaa taaagaaatt gatgatattg
1501 atgacagcat cgttgaattt gccgagattg gcgattttat taatcagccg gttaaaaact
1561 attccagcgg gatgaagtcg cgtctcggtt tcgcgatctc cgtgcatatt gatcctgaca
1621 ttttaattat tgacgaagct ctttctgtgg gggaccaaac gttttatcag aagtgtgtag
1681 acagaataaaa tgagtttaaa aagcaaggaa aaacgatttt ctttgtcagc cactcaatcg
```

```
1741 gtcagattga aaagatgtgt gaccgtgttg cttggatgca ctatggcgag cttcgtatgt
1801 ttgatgaaac aaaaacggtt gtgaaagagt acaaagcggt tattgactgg ttttaataagc
1861 tatcgaaaaa agaaaaagag acatataaaa aagagcagac agaagagagg aagaaagaag
1921 atcctgaagc gtttgcccggt ttccgcaaaa agaagaaaaa gccgaaatca ctggccaatg
1981 ccattcaaat tgctattttg tctattctga ctgtcttcat ggcgggaacg atgttcttta
2041 atgccccgct tcgtacaatt gcttcgtttg gcgctattcc gcaaaatgaa gtgaagaacc
2101 atcatggcga tgcaaagggc aagtcagagg aacgcttaac tgcaatcaat aagcaagggg
2161 ttatagcaaa tgaaaaagcg gctgcttata aggatcaggg tttgaaacag aaggctgacg
2221 ttacactgcc attcgggtaca aaagtaacgg tagctgcaaa aggcaaacia gcagcgaaaa
2281 taaagtttga cgggcactct tattatgtga aacagagcgc tggtgcaact aacatgaaac
2341 acgctgaatt gcatgccact gcatttacgt cttatgtctc gcaaaacgca gcatcttcct
2401 atgaatactt tctgaaattc ctaggagaca gcagcaccag cattcaatcg aaattgaatg
2461 gttatactga aggaaataag gctgacggca gaaaaacgct gaattttgat tatgaaaaaa
2521 tcagttatgt actggagaat gataaagcaa cagagcttat ttttcataac atttctccta
2581 tcaacccggc gtcactatcc ttaagtata gcgatgtatt gtatgacagc agcaagaagc
2641 gttttcttgt gaatacacat gatcagggtt ttgcagttga taatgaagag catacactga
2701 ctttgatgtt gaaataaaaa aaggctattg gatgaatgtc caatagcctt tttgtttaga
2761 tttcttcttt gtttagtaaa cttccataa atggaacgag
```

//

LOCUS BSU13979 4483 bp DNA BCT 30-JUL-1995
DEFINITION Bacillus subtilis minor teichoic acid synthesis genes ggaA and
ggaB, complete cds.
ACCESSION U13979
NID g915197
KEYWORDS .
SOURCE Bacillus subtilis.
ORGANISM Bacillus subtilis
Eubacteria; Firmicutes; Low G+C gram-positive bacteria;
Bacillaceae; Bacillus.
REFERENCE 1 (bases 1 to 4483)
AUTHORS Freymond, P. and Karamata, D.
TITLE Sequencing and analysis of two gga genes associated with the
synthesis of the minor teichoic acid of Bacillus subbtilis 168
JOURNAL Unpublished
REFERENCE 2 (bases 1 to 4483)
AUTHORS Freymond, P.
TITLE Direct Submission
JOURNAL Submitted (25-AUG-1994) Pierre-Philippe Freymond, Institut de
Genetique et de Biologie Microbiennes, Rue Cesar-Roux 19, Lausanne,
1005, Switzerland
FEATURES Location/Qualifiers
source 1..4483
/organism="Bacillus subtilis"
/strain="168"
/map="310 degrees"
RBS 165..172
/gene="ggaA"
gene 165..1519
/gene="ggaA"
CDS 179..1519
/gene="ggaA"
/codon_start=1
/function="involved in the secondary teichoic acid
synthesis"
/db_xref="PID:g915198"
/transl_table=11
/translation="MFSIIPIYNSENYLRYSIESVLNQSIGFKENIELILIDDGSVD
SSPQICESFKNLYPNNIKIMKIENSGPSAARNCGLSNVSESKFIGFLDSDDAFSQNA
LQSVYDFFCDSEHVNI AVL PVYYTGEKEGGHKLNNRFEKGTRVINILNDYKAIHFYIG
GTFYRRHTLTSTVLFDESIKFWEDAIFFNQLLLKEKRYGAVAEGKYFYRKRKEQDSL
V DRSWFNKKRYTYLLNECYMTLLMDSFNKYDIVLPYLQFLIVYHIKFLYLPNYRDVYKS
VLDQQEQRVFVDDFIKVLKFIDPQFIKEQDMPMYKEFMFHLLKENTEALENIKKERV
LHSSCTVTS AKIKGLRLELTGHFINQYYEMKENDRIYIKYFKRLKKCKRKELKKTIEV
WGYKL R DFRYAGFVVEIPIWAFADFVLKTPNDSLELNHVNI FKSLLTRVFKKR"
gene 1629..4345
/gene="ggaB"
RBS 1629..1633
/gene="ggaB"
CDS 1643..4345
/gene="ggaB"
/codon_start=1

/function="involved in the secondary teichoic acid
synthesis"

/db_xref="PID:g915199"

/transl_table=11

/translation="MNEKSFNYDFSVMPIYNVELYLTEAIESIINQITIGFENIQILIL
VNDDSPDKSEIICKEYAQKYPNNIVYAKKQNGGVSSARNYGLKYAEGRYIQFLDPDDL
VSEGTFFENVLNFDEHKNEIDIVAIPIFFAEGRTGEHNLNNKFSSTRILDVEKEPHHI
LTHCCSTFIKKDALKNIRFDENCKIGEDAKLVNLIISQKKKYGLVKEAKYHYRVREDG
SSAMQTAKANKWNFNHSLITFSKNLIDIIKNHEQKIPLFLQYVMVMDLKWLLIKDIS
ETPLDENYSEFLTIREVLSYIDDDVIIETKSVSHFYLYHALKIKHGENYSRYVYER
ETEQDYLYREGKIVSKLSDQTLTIEILEENEDSIHIEGFWSSLFNSKGFKFYAKIGE
TKIKAKNIKRQNDYISLGEVIKKYPGFSIDIPKGLADNHHIEFFITGKKRKLTKL
RFFKYSGLSNDLYNTYVAKKDYIFYNYKKLMFKNNFKNRFIKEFRFLKSLHKSGEK
SKKRKSAIKKALMARMVHHVFTIFNRKPVWLFIDRQDKADDNAEHLFKYAINKNDGVK
KYFIIKKDSKDYDRIKKYGVIPYRSFRHKILTSSSKVISTHADIWVVPFFNMEIY
FRDLNFEFIFLQHGITMADHSEWLNKYNKNIKLLVTSAPKEYSIVKGNYNKYKENI
LLGGFPRYDNLKKSEGEKQLLIMPTWRKDIVLPKDQAKGVRPYNPKFKDSEYFSRYNA
LINDERLIEFAKKNYKITFFPHPDIIQQQIVDFEKHDYVEFADYNSSYQMLFNSSNIM
ITDFSSVAFDFAYEKKPVIIYYQYKSYHFKLDYYDYKKMGFGDVLENHNSLVDKVIYY
MKNNSRMEDKYRKRVDNFFAYTDKNRRNRINAILELDNNKVAK"
4367..4420

terminator

BASE COUNT 1730 a 536 c 741 g 1476 t

ORIGIN

```

1 ggaaacttgc ttcaacaag tgaagaactt atagatacgg taaaagagtt gttacataat
61 ccttatatag atcataacta tgaggatttt tataataaat tttgtaattt agaagaggca
121 aggccttctaa aagagtaatt gaaacgatcc ttttaacttct aaataaagag gtacaaacat
181 gttttctata attataccaa tatataattc tgaaaattat ttaagatatt caatagagag
241 tgtccttaac cagtcaattg gatttaagga aaatatagaa ctgatattaa tagatgatgg
301 tagtggtgac agcagtcctc aaatttgtga atccttttaa aatctatatc ctaataatat
361 taaaatcatg aaaattgaaa actctggacc ttctgctgca agaaattgtg gattatcaaa
421 tgtaagcgaa agatctaaat ttattggttt tcttgattct gacgatgcat tctctcaaaa
481 tgcgctgcaa agtgtttatg attttttttg tgattccgaa catgtaaata ttgcggtatt
541 acctgtttat tacacagggtg aaaaagaagg gggacataaa ttaaataata gatttgaaaa
601 aggaacaaga gttataaata ttctcaacga ttataaagct attcattttt atattggcgg
661 cactttttac agaagacata cactaactag taccgtcctt tttgatgaat ctataaagtt
721 ttgggaagac gctatctttt ttaaccagtt attactgaaa gaaaaaagat acggagcagt
781 tgcagaagga aagtattttt atagaaaacg gaaagaacag gattctttag ttgatcggtc
841 atggttttaac aaaaaaagggt acacatatat gttgaatgaa tgttacatga ctttgttgat
901 ggatttcattc aacaaatatg atatagtttt gccttatttg caatttttaa ttgtatata
961 tataaaaactg tttttatatc cgaactatag agatgtttat aagtctgttt tagatcaaca
1021 agaacaaaga gtttttgttg atgattttat taaagtttta aaatttattg acccgcaatt
1081 tataaaagaa caagatatgc cgatgtacta taaagaattt atgtttcact tattaaga
1141 aaatacagaa gctcttgaaa atataaaaaa agaaagagta ctgcatagtt catgtactgt
1201 tacttcggca aaaataaaaag ggcttagact tgaattaaca gggcacttta ttaaccagta
1261 ttatgagatg aaagaaaatg acagaatata tataaaatat tttaaaagat taaaaaatg
1321 caaacgaaaa gaactgaaaa aaacaattga agtatgggga tataaattaa gagatttttag
1381 atatgctggt tttgttgtcg aaataccgat ttgggccttt gcatttgact ttgtactaaa
1441 aacaccaaatt gattcttttag aacttaacca tgtgaacatt tttaaaagtt tgcttacaag
1501 ggttttttaa aaaaggtaag gaatgctttt catacatttt actaaattaa aattgttttg
1561 caaaaattag tactctcttg tttcttaatt ttatttacct gaattcttat tcatataaac
1621 attatggttag gagtaatctt ttatgaacga aaaaagtttt aactatgatt tcagtgttat
1681 aatgccgatt tataatgttg agttgtatct cactgaagct atagaaagta tcattaacca
1741 aactattggt tttgagaata ttcagttaat actggtgaat gatgatagcc ccgataaaag

```

```

1801 tgaaatcatt tgtaaagaat atgctcagaa atatcccaat aacattgtct atgcaaagaa
1861 acagaatggc ggagtgagca gtgctcgaaa ttatggttta aagtatgctg aaggtagata
1921 tattcaattt ttggatccgg atgatttagt ttcagaagga acattcgaaa atgtttttaa
1981 cttctttgac gaacataaga atgaaattga tattgtagca atccctattt tttttgcaga
2041 aggaagaact ggagaacata atctaaataa taagttttct tctacaagaa ttttgatgt
2101 agaaaaagaa ccgcatcata tattaactca ttgttgttct acatttataa aaaaagatgc
2161 cttgaaaaat atcaggtttg atgaaaattg taaaataggt gaagatgcca aactagttaa
2221 tttaatcata tcgcaaaaga aaaagtatgg tctggttaaa gaggcaaaat accattatag
2281 agttagagaa gatggatcat ctgccatgca gactgctaaa gcaataaaga attggtttaa
2341 ccattcactt atcactttct caaagaattt aatcgatatt ataaaaaatc atgaacagaa
2401 aataccttta tttcttcaat atatggttat gcatgatttg aagtggaaat tattgattaa
2461 ggatatacgt gaaacacctt tagacgaaaa gaataacagt gaatttttaa cattgtatcg
2521 agaagtattg tcgtatattg acgacgatgt catcattgaa acaaaaagtg tcagccattt
2581 ctatttatat catgctttta aaataaagca cggtgaaaat tatagtaggt atgtatatga
2641 aagagaaact gaacaggatt attattttata cagagaaggt aaaattgttt cgaaattatc
2701 ggatcaaact ttaactattg aaatttttaga agaaaatgag gattccattc acatagaagg
2761 cttttggagc tcgctgttta attctaaagg ttttaagttt tatgctaaaa ttggcgaaac
2821 aaaaataaaa gcaaagaata taaaaagaca gcataatgat tatataagtt taggagaagt
2881 aataaaaaaa tatcccgggt tttcaataga tattccaaa ggcatctag cagataatca
2941 tcatattgag ttttttataa ctaagggtta aaaaaggaag ttgacaaaac ttcgtttttt
3001 caagtattca ggtttgtcaa acgattttata taatacttat gtggctaaaa aagattatat
3061 tttttattat aattataaaa aattaatggt caaaaaaac aatttttaaa atagatttat
3121 aaaagagttt cgtttcttaa aatccctaca taaatcaggg gaaaaatcaa aaaaacgaaa
3181 atcagcgatt aagaaggcac tgatggcaag aatggtacac catgttttca ctatttttaa
3241 tagaaaacca gtatggttat tcatagacag acaagacaaa gctgatgata atgccgagca
3301 cctcttttaa tatgcaatca acaagaatga tggggtaaaa aaatacttta taataaaaaa
3361 agatagcaag gattacgaca gaatcaaaaa atatggaaag gtcataccat acagatcttt
3421 tagacataaa attttaacct tatcctcttc caaagtaata tcgacacatg cagatatatg
3481 ggttgtaaat ccattttttta atatggagat ttatttttaga gatttattta actttgagtt
3541 tatcttttta cagcacggaa taacaatggc agatcattct gaatggttta acaaatacaa
3601 caagaatatc aaattattag tcacttctgc caaacctgaa tatcggtcta ttgtgaaagg
3661 gaattacaac tataaaaaag agaatatttt gttgggtgga tttccgagat acgataatct
3721 taagaagagt gagggagaaa agcaacttct aataatgccg acttgagaaa aagatattgt
3781 attaccgaaa gatcaggcaa aaggagtaag accgtacaac ccgaaattta aagatagtga
3841 atatttttct aggtataatg ctttgattaa tgatgaacgg ctaatcgaat ttgctaagaa
3901 aaataattat aaaataactt tttttcctca ccagatatt cagcaacaga ttgtagactt
3961 tgaaaagcat gattatgtgg agtttgccga ctataacagc agctatcaaa tgctatttaa
4021 ttctttctaa ataataatta ctgatttttc atctgttgcg tttgattttg catatgagaa
4081 aaaacctggt atttattatc aatacgaaaa gtcataccat tttaaacttg attattatga
4141 ttataaaaaa atggggtttg gtgatgtatt agaaaatcat aatagcttag tggataaagt
4201 tatctattat atgaaaaaca atagtcgtat ggaagataag tatagaaaaa gagtagataa
4261 cttttttgca tatactgata aaaataatag gaatcgtatt tataatgcta ttttggaatt
4321 agataataat aaagttgcta aatgaggttg gtttgtttta tattgacact tcaaatgttg
4381 ggagaagttc tgcgagactt ctctttactt tttaaaagtg aaaaaaactc aacatttgtt
4441 acaatattca ctggtacttt taaatttctt taaccgaaag atc

```

//